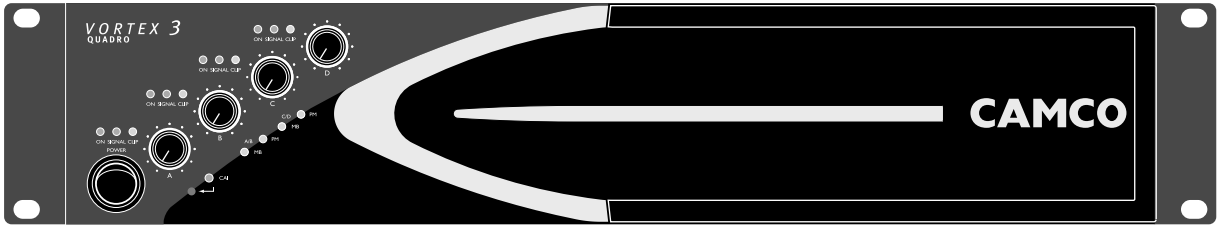

INFORMATION FOR USE FOR VORTEX 3 QUADRO

V3QUM_GB_2004-2005-R1_01-2005

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für Beschallungs- und Beleuchtungsanlagen
Fischpicke 5, D-57482 Wenden, Germany
Telephone +49 (0) 27 62/4 08- 0

VORTEX SERIES

IMPORTANT SAFETY INSTRUCTIONS

1) Read the information for use (user manual).

2) Please keep this user manual in a safe place during the lifetime of the amplifier. The user manual forms an integral part of the amplifier. Reselling of the amplifier is only possible if the user manual is available. Any changes made to the amplifier have to be documentated in writing and passed on to the buyer in the event of resale.

3) Heed all warnings.

4) Follow all instructions.

5) Do not use this amplifier near water (for example, in damp rooms or near a swimming pool).

6) Clean only with dry cloth.

7) Do not block any ventilation openings. Install in accordance with the user manual.

8) Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.

9) Protect the power cord from being walked on, pinched or damaged in any other way. Pay particular attention to plugs and the point where they exit from the amplifier.

10) The amplifier may only be used in accordance with the information provided in the user manual. Before and during the usage of the amplifier please ensure that all recommendations, especially the safety recommendations as detailed in the user manual , are adhered to.
The **VORTEX**–Amplifier is designed for the amplification of pulsed audio signals and the amplifier should only be connected to speakers with an average impedance that is not lower than the impedances specified in points *3.8.3, 3.8.4* and *3.8.5.*

11) Do not place this amplifier on an unstable cart, stand, tripod, bracket, or table. The device may fall, causing serious injury, and serious damage to the device itself.

12) The amplifier can only be disconnected from the power supply by removing the plug, which must be freely accessible at all times. Unplug this amplifier during lightning storms or when unused for long periods of time.

13) Refer all servicing to qualified service personnel.
Servicing is required when

- the power-supply cord or plug is damaged,
- liquid has been spilled or objects have fallen into the amplifier,
- the amplifier has been exposed to rain or moisture,
- the amplifier has been dropped or suffered damage in any other way.
- the amplifier exhibits a distinct change from its normal function or performance.

CAUTION
RISK OF ELECTRIC SHOCK DO NOT OPEN

CAUTION – HIGH VOLTAGE HAZARDS EXIST WITHIN THIS PRODUCT. REFER ALL SERVICING TO AUTHORISED PERSONNEL

THE LIGHTNING FLASH WITH ARROW HEAD SYMBOL, IS INTENDED TO ALERT THE USER TO THE PRESENCE OF UNINSULATED DANGEROUS VOLTAGE WITHIN THE PRODUCT'S ENCLOSURE

THE EXCLAMATION MARK IS INTENDED TO ALERT THE USER TO IMPORTANT INSTRUCTIONS ALSO FOR MAINTENANCE IN THE LITERATURE ACCOMPANYING THE AMPLIFIER

THE LIGHTNING FLASH WITH ARROW HEAD SYMBOL ALERTS THE USER TO DANGEROUSLY HIGH VOLTAGE AT THE SPEAKON CONNECTORS THAT COULD POTENTIALLY BE LIFE THREATENING.

CAUTION – RISK OF ELECTRIC SHOCK – DO NOT OPEN

WARNING – TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS AMPLIFIER TO RAIN OR MOISTURE

THE AMPLIFIER MAY ONLY BE CONNECTED TO A SOCKET WITH A CONNECTION TO GROUND.

1. Read the information for use (user manual)

When shipping the **VORTEX** amplifier, always use the original shipping carton and packing materials. For maximum protection, repack the unit as it was originally packed at the factory.

2. Environments

Use this amplifier only in E1, E2, E3 or E4 environments according to EN55103-2 – Electromagnetic compatibility – Product-family norm for audio, video and audio-visual installations as well as for studio-and lighting-control inastallations for professional applications – Part 2: Immunity.

3. Ventilation

Slots and openings in the cabinet are provided for ventilation, to ensure reliable operation of the amplifier and to protect it from overheating. These openings must not be blocked or covered. This amplifier should not be installed unless proper ventilation is provided or manufacturer's instructions have been adhered to.

4. Water And Moisture

Do not use this amplifier near water (for example, in damp rooms or near a swimming pool).

5. Cleaning

Unplug this amplifier from the wall outlet before cleaning. Do not use liquid or aerosol cleaners.

6. Power-cord Protection

Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon them or against them, paying particular attention to cords and plugs, and the point where they exit from the amplifier.

7. Lightning

For added protection of this amplifier during lightning storms, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet. This will prevent damage to the amplifier due to lightning and power-line surges. Disconnection from the mains power supply can only be achieved by removing the plug from the mains socket and by external disconnecting all poles from the mains.

8. Interference of external objects and/or liquids with the appliance

Never push objects of any kind into this amplifier through openings as they may touch dangerous voltage points or short out parts that could result in a fire or electric shock. Never spill liquid of any kind on the amplifier.

9. Accessories

Do not place this amplifier on an unstable cart, stand, tripod, bracket, or table. The amplifier may fall, causing serious injury, and serious damage to the product. Any mounting of the amplifier should follow the manufacturers instructions, and should use a mounting accessory recommended by the manufacturer.

10. Connecting

When you connect the amplifier to other equipment, turn off the power and unplug all of the equipment from the supply source. Failure to do so may cause an electric shock and serious personal injury. Read the user manual of the other equipment carefully and follow the instructions when making the connections.

11. Sound Volume

Reduce the volume to minimum before you turn on the amplifier to prevent sudden high levels of noise (decibel) which may cause hearing or speaker damage. *(See also 4.2.1 Volume control)*

12. Damages that require service

Unplug this amplifier from the mains supply and refer to your dealer/distributor or other authorised repair workshop if any of the following situations occur:

- if liquid has been spilled, or objects have fallen into the amplifier
- if the amplifier does not operate normally as described in the user manual. Operate the controls only as described in the user manual.
- if the amplifier has been dropped or damaged in any other way.
- when the amplifier exhibits a distinct change from its normal function or performance.

13. Servicing

Do not attempt to service this amplifier yourself. As opening or removing covers may expose you to dangerous voltage or other hazards, the amplifier may only be opened by qualified personnel. Please refer to your dealer/distributor.

14. Servicing and Replacement Parts

All service and repair work must be carried out by a **CAMCO** authorised dealer. When replacement parts are required, please ensure that the dealer/distributor only uses replacement parts specified by the manufacturer. The use of un-authorized replacement parts may result in injury and/or damage through fire or electric shock or other electricity-related hazards.

15. Safety Check

Upon completion of any service or repairs to this product, ask the dealer/distributor to perform safety checks to determine that the amplifier is in proper operating condition.
Recommendations on how to carry out the safety test can be found in DIN VDE 0701-1 Maintenance, Modification and Test of Electronic Appliances.

EC Declaration of Conformity in accordance to EC Directives:
electro-magnetic compatibility (Council Directive 89/336/EEC,
as amended by Directives 92/31/EEC and 93/68/EEC);
low-voltage electrical equipment (Council Directive 73/23/EEC)

Manufacturers Name:
CAMCO Produktions- und Vertriebs- GmbH
für Beschallungs- und Beleuchtungsanlagen

Manufacturers Address:
Fischpicke 5, D-57482 Wenden – Germany

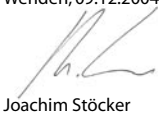
Declares that the product with the model name:
CAMCO Power amplifier **VORTEX-3-QUADRO**

Conforms to the following standards:

- EN60065 Security
- EN55103-1 Emission
- EN55103-2 Immunity

The operating conditions and application environments presupposed in the information for use (user manual) are to be kept accordingly.
Please Note: The following formulations have been chosen:
VORTEX-3-QUADRO for the type plate and for the EC declaration of conformity.
VORTEX 3 QUADRO for the front face of the appliance and for the text in the user manual.

Wenden, 09.12.2004



Joachim Stöcker

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1.1 Welcome to CAMCO

Established in 1983, **CAMCO** has gained worldwide experience with professional sound reinforcement technology. Within the audio market, **CAMCO** specialises in the production and marketing of high quality power amplifiers and sound systems for use both on tour and in static installations.

The success of the **LA, DL** and **DX** series power amps has made the **CAMCO** name synonymous with professional quality, high performance and utterly reliable power amps.

CAMCO's commitment to research and development, seen not just in the area of materials and technology but also most importantly in its highly skilled and motivated workforce, is one of the keys to its ongoing success.

With its all-new **VORTEX** power amp series, **CAMCO** is pioneering a new dimension in professional power amp construction. The seamless combination of groundbreaking technology with secure and proven elements is the hallmark of the new series.

Welcome to the new world of professional power amplifiers –

WELCOME TO CAMCO!

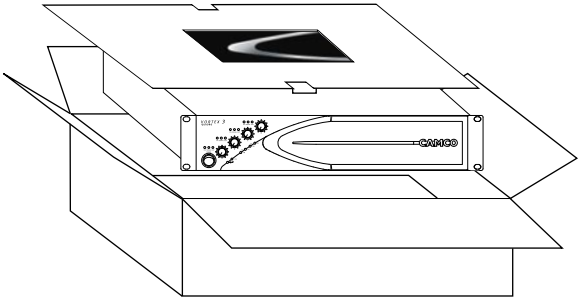
1.2 Unpacking

Please unpack and inspect your new amplifier for any damage that may have occurred during transit. If damage is found, notify the transportation company immediately. Only you the consignee may initiate a claim for shipping damage. **CAMCO** will be happy to cooperate fully as needed. Please save the shipping carton as evidence of damage for the shipper's inspection.

Even if the amplifier has arrived in perfect condition, save all packing materials so you will have them if you ever need to transport the unit.

NEVER SHIP THE AMPLIFIER WITHOUT THE ORIGINAL PACKING MATERIALS.

When shipping the **VORTEX** amplifier, always use the original shipping carton and packing materials. For maximum protection, repack the unit as it was originally packed at the factory.



1.3 The Amplifier

The **VORTEX 3 QUADRO** is a Class-H four channel power amplifier with a power output of 750 W per channel / 4 Ω load (1,5 kW in stereo / 2 Ω or 8 Ω load). These four channels are subdivided in two stereo amplifiers A/B and C/D which can be independently set to stereo, Mono-Bridge or Parallel-Mono operation.
This feature guarantes the most flexibility of the **VORTEX 3 QUADRO**.
It is supplied by Switched Mode Power Supplies (SMPS). These SMPS's radically reduce the weight and size (only 2U) of the amplifier. Using SMPS, the 2 symmetrical supply voltages of the power amplifier are more stable than the power supplies used in conventional amplifiers.

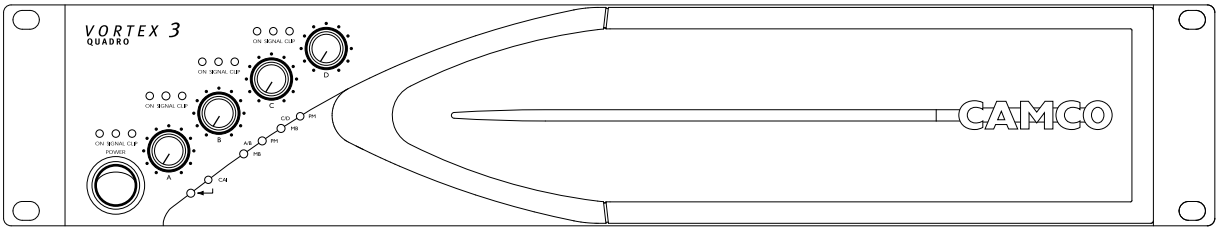
The **VORTEX** also uses three microprocessors for controlling and monitoring the power amp. Controlling a power amp designed for use in modern sound systems, has four main advantages over more traditional power amp systems:

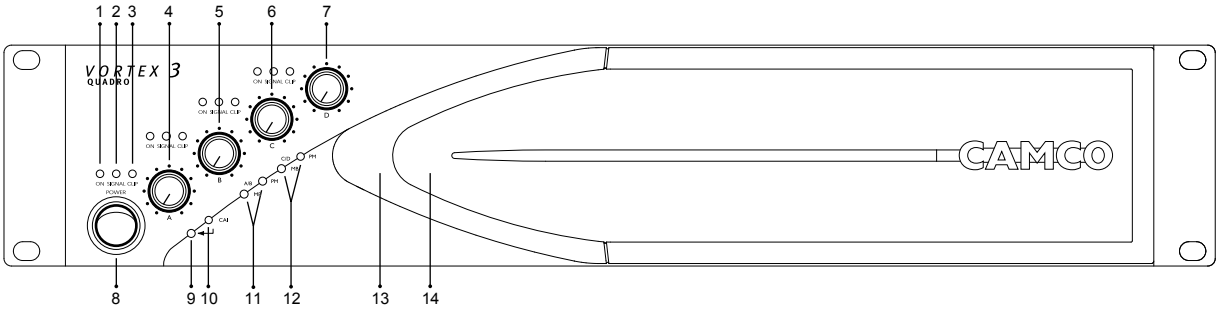
- Reduced Distortion
- Improved Noise Characteristics
- Integrated Remote Control
- Indication of protection or failures by different LED sequences

The **VORTEX** has been designed as an intelligent and powerful product for performing specialised tasks within a complex audio system. Users can adapt the power amp to meet their specific audio requirements before use. Controls mounted on the front and the rear of the **VORTEX** allow access to the functionality.

Since some of the externally mounted controls have multiple functions, it is important that users should familiarise themselves with the entire range of controls and programmable features before using the power amp.

If you have questions about features of the **VORTEX** power amp that are not covered by the basic descriptions in this manual, **CAMCO** would be pleased to offer you further information. Alternatively, contact your dealer/distributor.



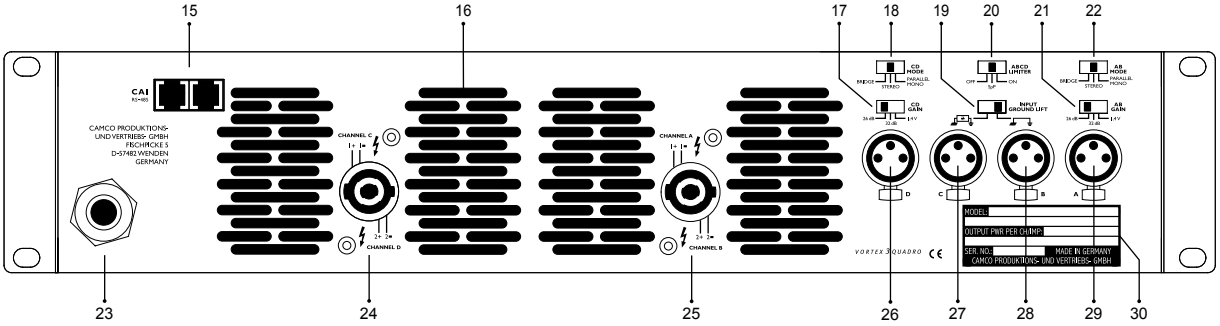


VORTEX 3 QUADRO – The Front

1 On LEDs (multifunctional)
2 Signal LEDs
3 Clip LEDs (multifunctional)
4 Volume Control – Channel A
5 Volume Control – Channel B
6 Volume Control – Channel C
7 Volume Control – Channel D
8 On/Off Switch
9 Enter-Switch (behind Front Panel)
10 CAI Status Indicator
11 Operating Mode Indicators ch. A/B
12 Operating Mode Indicators ch. C/D
13 Removable Air Filter System
14 Cooling Air Inlet Vents

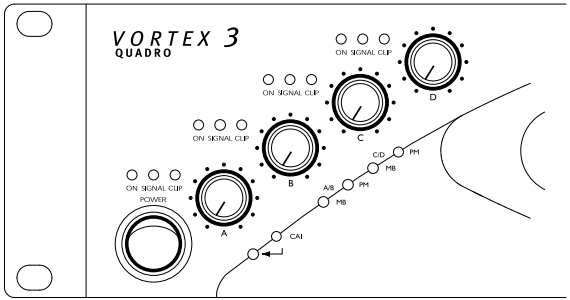
VORTEX 3 QUADRO – The Rear

15 CAMCO Audio Interface (CAI)
16 Cooling Air Outlet Vents
17 Gain Selector ch. C/D
18 Mode Selector ch. C/D
19 Input Ground Lift Switch
20 Limiter Switch ch. A/B/C/D
21 Gain Selector ch. A/B
22 Mode Selector ch. A/B
23 AC Power Cable
24 SPEAKON Outlet ch. C/D
25 SPEAKON Outlet ch. A/B
26 XLR-Line Input ch. D
27 XLR-Line Input ch. C
28 XLR-Line Input ch. B
29 XLR-Line Input ch. A
30 Rating Plate



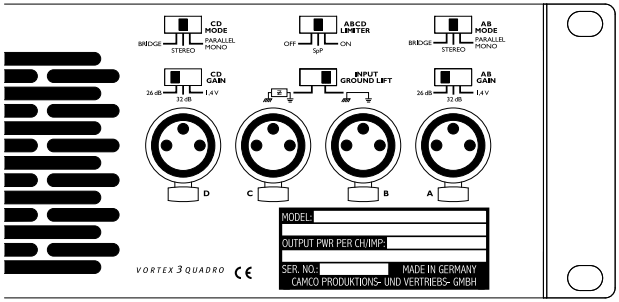
2.3 Factory settings

VORTEX 3 QUADRO amplifiers are delivered with the following factory settings



Front panel:

Power switch	Off	Amplifier is switched off



Rear panel:

Mode Channel C/D	Stereo
Limiter	SpP
Mode Channel A/B	Stereo
Gain Channel C/D	26 dB
Input Ground Lift	Grounded
Gain Channel A/B	26 dB

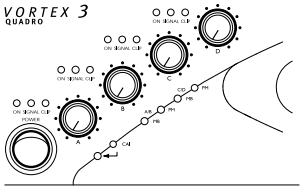
3.1 On/Off Switch

NOTE: This switch does NOT disconnect the amplifier from mains.

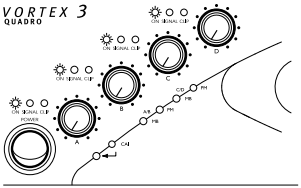
The switch initiates start-up by activating the current limiting function.

As soon as the power amplifier is connected to the mains power supply, a voltage is supplied to both the line-filter and the fused input of the controllable rectifier. Disconnecting the amplifier from the main power supply can only be achieved by physically separating the amplifier from the mains by pulling the mains plug. The mains plug therfore has to be freely accessible. Disconnect the mains plug from the mains during a lightning storm or when the amplifier remains unused or un-supervised for a prolonged period of time. Alternatively, you can disconnect the amplifier via an external all-pole disconnection from the mains.

If a power cut occurs while the amplifier is switched on, it will restart automatically once the power supply has been restored. All settings operation prior to the loss of power will be maintained.



Amplifier ist switched off.



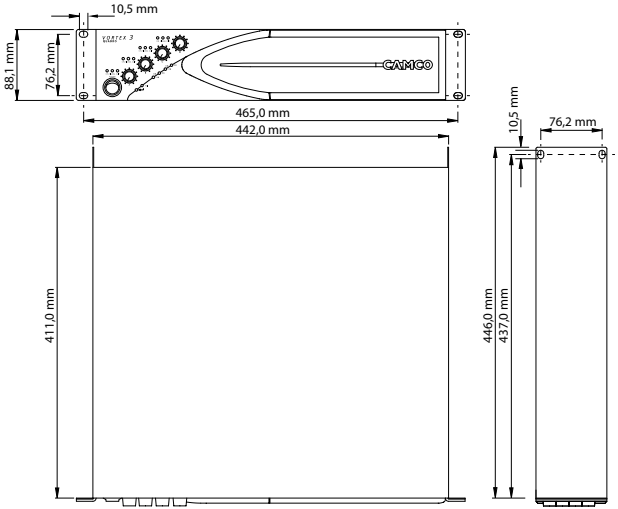
Amplifier is switchen on
(On LEDs are lighting up).

3.2 Precautions

When mounting or connecting the amp always disconnect it from mains.

3.3 Mounting

Use four screws and washers when mounting the amplifier to the front rack rails. For mobile use, the amplifier should also be secured using the 19" mounting elements on the rear panel.



3.4 Cooling

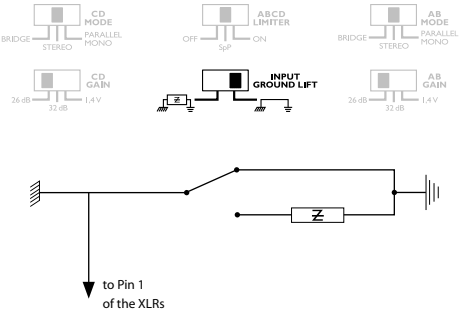
Under normal operation of the power amp, overheating should never be a problem. The air is taken in from the front and out through the back, it is of course essential that while the power amp is running air is able to circulate around it freely.

The temperature of the cooling air will depend on the immediate environment (e.g. an enclosed rack, direct sunlight) and on whether the front filter is clogged. If the amp is installed in a case, the open area at the back of the case must be at least 140 cm². This area should be in line with the amp.

If this can not be achived a forced ventilation system has to be used.

3.5 Ground Lift

The input signal ground (pin 1 for all 4 XLRs) is tied to the ground potential in the mains supply. Opening the ground lift switch causes this connection to be broken. This allows ground loops that sometimes occur in practice to be eliminated. The ground potential of the power amp and therefore of the loudspeaker outputs is independent of the switch setting and remains at the ground potential of the mains supply.

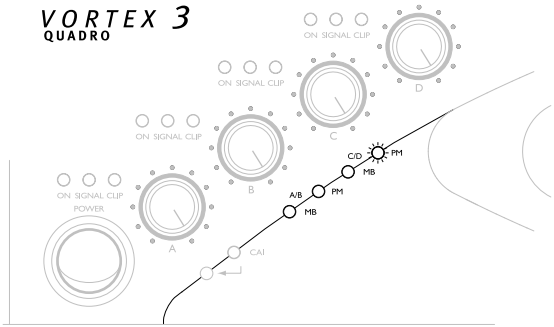


Removing or taping the mains connector ground is illegal and dangerous.

DO NOT REMOVE MAINS CONNECTOR GROUND
IT IS ILLEGAL AND DANGEROUS

3.6 Mode Indicators

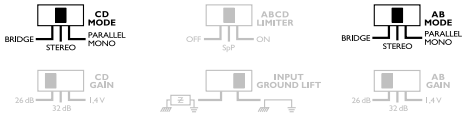
On the front panel there are two pairs of yellow LEDs (A/B, C/D) to indicate the modes that are set to the amplifiers A/B and C/D. In stereo mode none of them will be lit. In Parallel-Mono the (PM) LED and in Mono-Bridge the (MB) LED will be lit.



Example: **VORTEX 3 QUADRO** in three channel operation,
A/B is set to stereo (no LED lit) and C/D to parallel-mono mode (PM lit).

3.7 Mode Selectors

The switches AB MODE and CD MODE on the rear panel change the operating mode of the appropriate amplifier (A/B , C/D). Moving one of these switches will shutdown the **VORTEX 3 QUADRO** and restart it in the new operating mode.

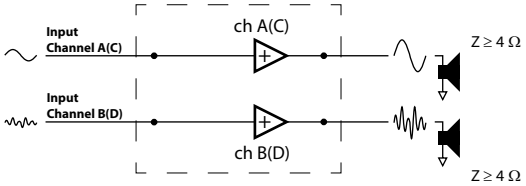


3.8 Basic Concepts

The **VORTEX 3 QUADRO** consists of two Stereo amplifiers A/B and C/D. Both of them are capable to work independently in Stereo, Mono-Bridge or Parallel-Mono. Following you will find a description about these modes for amplifier A/B (in parenthesis the appropriate channels of amplifier C/D).

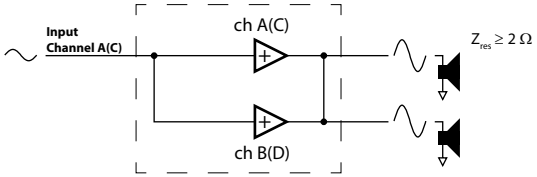
3.8.1 Stereo Operation

Two fully independent amplifier channels (normal operating mode).



3.8.2 Parallel-Mono Operation

Parallel operation of the two channels together.

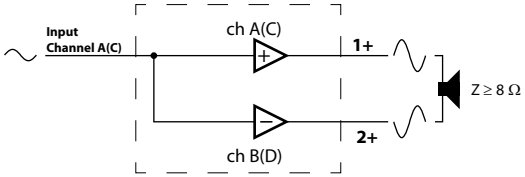


The output terminals of the two channels are configured in parallel using an internal relay. The (single) load is connected either to the output of channel A(C) or to that of channel B(D) (as if in stereo). While the total output of the amplifier remains the same and the output voltage level is also the same as in stereo operation, the minimum impedance that can be connected is reduced by half due to the fact that current capability is doubled. Only Channel A(C)-Input is active.

NOTE: For Parallel-Mono Operation, to prevent damage of one SPEAKON connector and to reduce loss of power because of contact or cable resistance, it is highly recommended to wire speaker loads using SPEAKON connector with all contacts connected.

3.8.3 Mono-Bridge

One-channel mono bridged operation.



The second channel processes the same input signal, but with reversed phase. The (single) load is connected between the two positive channel outputs (1+/2+) using a suitable connected SPEAKON connector. While the total output of the amplifier remains the same, both the available output voltage and the minimum impedance that can be connected are doubled, as compared with stereo operation. Only Channel A(C)-Input is active – turn the volume on Channel B(D) down to zero.

WARNING!

In Mono-Bidge mode RMS output voltages are as high as 230 V. Wiring to the speaker loads must conform to NEC Class 3 safety standards or its equivalent that meets all national and local electric codes.

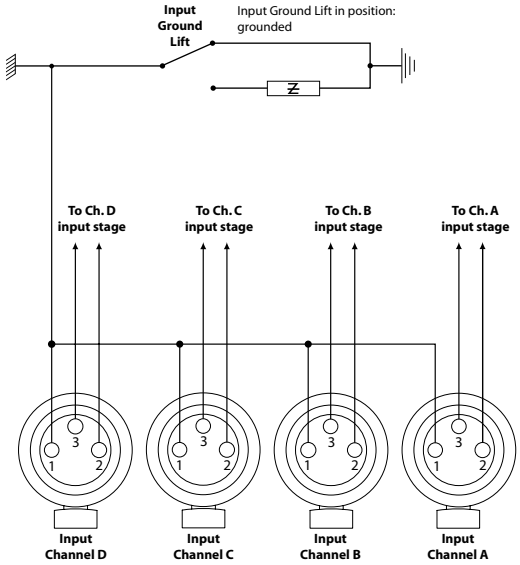
All customer specific cables may only be manufactured by qualified suppliers/personnel. All cabeling or rewiring work must be carried out by qualified personnel.

3.9 Wiring

3.9.1 XLR Connection

XLR: Pin 1 Ground (or lifted via 15 Ohm resistor)
Pin 2 Hot
Pin 3 Cold

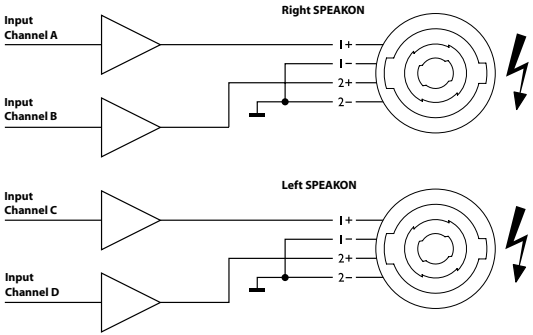
Always use symmetrical (balanced) shielded cable to connect the amplifier.



3.9.2 SPEAKON Connection

The SPEAKON connectors are connected as shown below.

Right SPEAKON: (view from the rear)	Pin 1+	Channel A speaker signal
	Pin 1 -	Channel A speaker ground
	Pin 2 +	Channel B speaker signal
	Pin 2 -	Channel B speaker ground
Left SPEAKON: (view from the rear)	Pin 1+	Channel C speaker signal
	Pin 1 -	Channel C speaker ground
	Pin 2+	Channel D speaker signal
	Pin 2 -	Channel D speaker ground



WARNING !

SPEAKON connectors marked with the lightning flashes indicate high voltages that are potentially life threating.

Wiring to these terminals requires installation by an instructed person or the use of ready-made leads or cords.

Custom wiring should only be carried out by qualified personnel.

To prevent electric shock, do not operate the amplifier with any of the conductor portion of the speaker wire exposed.

NOTE:

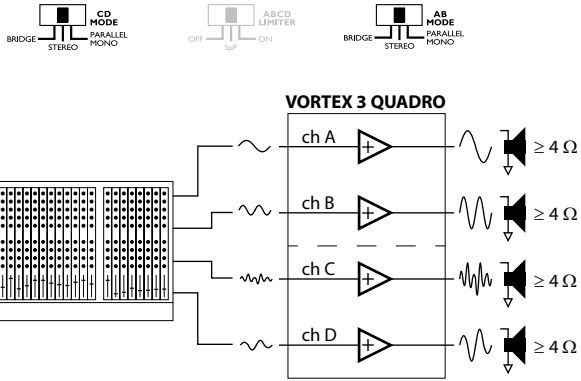
For reasons of safety and performance, use only high-quality fully insulated speaker cables of stranded copper wire. Use the largest wire size that is economically and physically practical, and make sure the cables are no longer than necessary.

IMPORTANT:

When connecting speaker cabinets in parallel, always use all the contacts in both SPEAKON connectors. If not, this may cause permanent damage to the connectors and considerably reduce performance.

3.9.3 Four-Channel Operation

Four fully independent amplifier channels give the opportunity of use in several applications, such as: multi-channel monitor systems, four channel reproduction, compact amplification in active 2- or 4-way systems ...



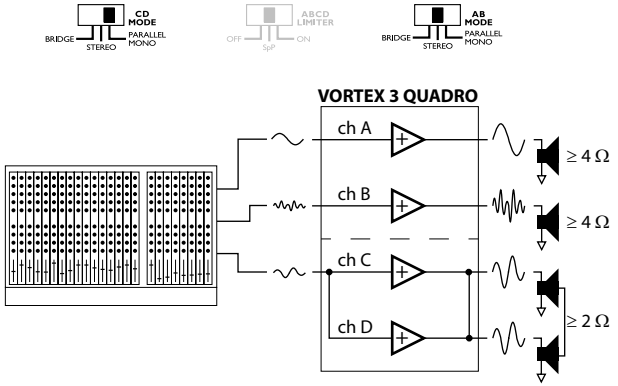
3.9.4 Three-Channel Operation

Three-Channel Operation is the choice for eg. stereo systems with subwoofer or compact amplification in active 3-way systems

With its capability to be set to Mono-Bridge or Parallel-Mono the **VORTEX 3 QUADRO** gives the possibility to be adapted to the impedance of your sub-woofer .

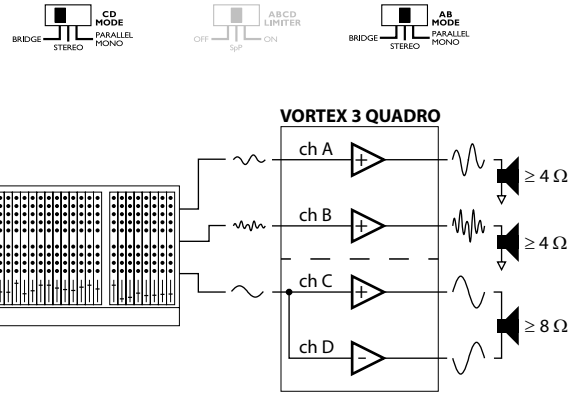
3.9.4.1 Stereo / Parallel-Mono

With one amplifier set to Parallel-Mono the **VORTEX 3 QUADRO** is capable to drive a two ohms load.



3.9.4.2 Stereo / Mono-Bridge

If you have a high-impedance load you can set the appropriate amplifier to Bridge-Mono operation.

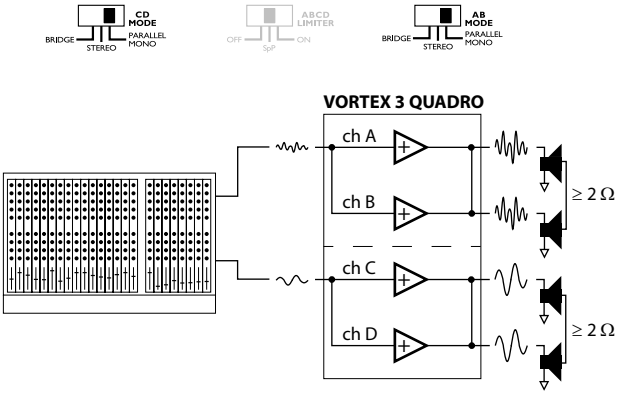


3.9.5 Two-Channel Operation

With amplifiers A/B and C/D set to mono modes you will nearly have a normal stereo amplifier with the exception that you are able to choose either to drive minimum loads of 2 Ohms or 8 Ohms.

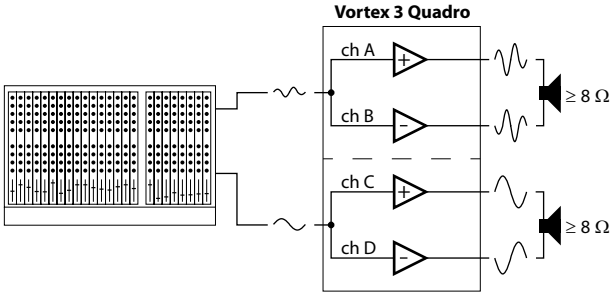
3.9.5.1 Parallel-Mono / Parallel-Mono

To drive two 2 Ohms loads just set the mode selectors to Parallel-Mono operation.



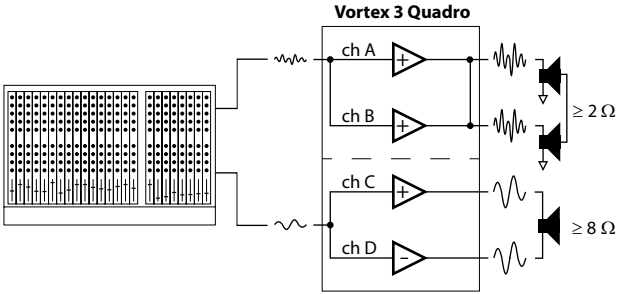
3.9.5.2 Mono-Bridge / Mono-Bridge

With its mode selectors set to Mono-Bridge the **VORTEX 3 QUADRO** is able to control high impedances.



3.9.5.3 Parallel-Mono / Mono-Bridge

It is also possible to set one amplifier to Parallel-Mono and the other to Mono-Bridge operation.



4.1 Precautions

Only connect the VORTEX amplifier to an appropriate AC circuit and outlet, according to the requirements indicated in the second row on the rating plate.

MODEL: VORTEX-3-QUADRO
230 V ~ 50/60 Hz 7,8 A 1070 W
OUTPUT PWR PER CH/IMP: 750 W / 4 Ohm
SER. NO.: xxxxx MADE IN GERMANY
CAMCO PRODUKTIONS- UND VERTRIEBS- GMBH

Exemplary a rating plate of **VORTEX 3 QUADRO**

Power Supply Data:

	Voltage	Mains Frequency	Current	Power Consumption
VORTEX-3-QUADRO	100 V			
VORTEX-3-QUADRO	120 V	50/60 Hz	24 A	1800 W
VORTEX-3-QUADRO	220 V	60 Hz	7,8 A	1070 W

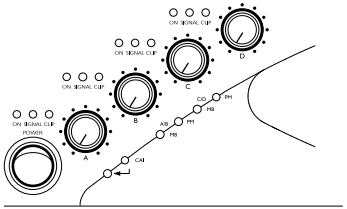
NOTE: Even under normal conditions the mains current can reach levels up to 60 A (230 V) and 120 A (120 V), respectively; this could cause lamps to flicker if connected to the same mains as the amp. The impedance of the AC circuit should be less than 0.157 Ohms to avoid flicker according to EN61000-3-11. (Electromagnetic compatibility – section 3 – 11: limits; limitation of voltage changes, voltage fluctuations and flicker in the public LV supply; equipment and appliances consuming more than 75 A current are subject to special conditions for connection/installation) If in any doublt, consult your local power provider. Never attempt to measure this impedance level with your ohmmeter. This may damage your meter and expose you to the risk of electric shock!

4.2 Controls

4.2.1 Volume Control

Two microprocessor-controlled DCAs (Digital Controlled Attenuator) with a control resolution of 12 bits per channel is integrated into the signal path. This means that the signal is not subject to an A/D followed by a D/A conversion with associated losses. Each channel is governed by a linear potentiometer with 41 notched settings. These settings have been selected to correspond to human hearing characteristics (logarithmically) and therefore guarantee an optimal range of settings for practical applications. Each channel can be set individually except when operating in mono mode whereby only ChA (C) is active.

Using an intelligent DCA control (Digital Controlled Attenuator) instead of the "conventional" VCA results in considerably reduced distortion as well as improved noise characteristics.



Set the volume to zero before turning on the amplifier to prevent the occurrence of sudden high volume levels which may cause damage to your hearing and/or the speakers.

The volume pots are also used to set the CAI-address. *(See 5.2.2 CAI Address Settings)*

4.2.2 Gain Selector

Two switches on the rear of the **VORTEX** allows the maximum amplification attainable to be set directly in the input stage of each amplifier (A/B, C/D).

The **VORTEX** amplifier has a 26 dB and 32 dB voltage gain setting along with a 1,4 V sensitivity setting.

Model		26 dB	32 dB	1,4 V
VORTEX 3 QUADRO	4 Ω / 750 W	2,75	1,38	
	8 Ω / 450 W	3,01	1,51	32,64

4.2.3 Limiter Switch

This switch is located at the rear of the **VORTEX**. It allows you to set the mode of the limiter. This limiter affects both channels in both amplifiers There are three modes: *(See 4.4.1 Clip Limiter and 4.4.4 Speaker Protect Limiter)*

Right position:
Clip Limiter: On
Speaker Protect: On

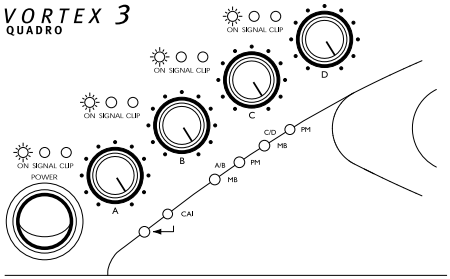
Middle position:
Clip Limiter: Off
Speaker Protect: On

Left position:
Clip Limiter: Off
Speaker Protect: Off

4.3 Indicators

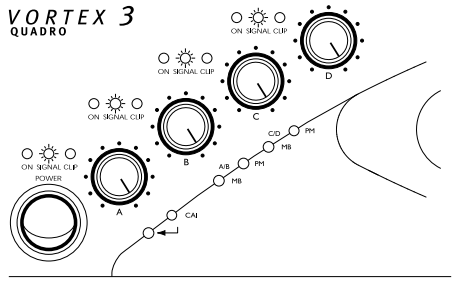
4.3.1 On LEDs (multifunctional)

Under normal operation, after the amp has started, the green power LEDs are permanently lit. A variety of different sequences of flashing LEDs are used to indicate other operating states and errors in one of the channels of the power amp. *(See 6.1 On LED Flashing Sequences)*



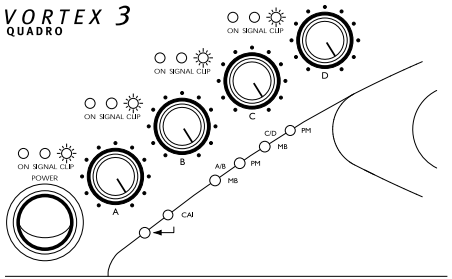
4.3.2 Signal LEDs

The green signal LED is illuminated when the voltage level at the output reaches approx. 4 V; this corresponds to a power of approx. 4 W at an impedance of 4 Ohms.



4.3.3 Clip LEDs (multifunctional)

The clip LEDs are bi-coloured: green/red. Each colour indicates a different status.



The intensity of the green light is defined by the current passing through the output stage of each channel (lowest brightness is proportional to approximately 1 A, the maximum brightness reflects the maximum output current). The red colour indicates the amount of signal clipping in each respective channel. If the green LED (current indicator) and red LED (clipping indicator) light up simultaneously, the Clip LED is yellow.

If the amplifier is overdriven for prolonged periods, the Clip LED will appear red to alert the user more effectively (the green component of the LED is switched off).
Monitoring the output current and clip via the LEDs can aid the detection of incorrectly wired components and faults in the loudspeakers at an early stage. *(See 6 Troubleshooting)*

4.4 Power Amp Protection Systems

4.4.1 Clip Limiter

If the power amp is overdriven, the clip detection circuit triggers the microprocessor. The processor reduces input signal level by controlling the DCA. The strategy is implemented in software. For sinusoidal input signals the microprocessor limits the input signal in such a way that non-linear distortions of the signal never exceed 1 %.
The clip limiter can work on each channel independently (except in mono-operation). To disable the Clip Limiter, *see 4.2.3 Limiter Switch.*

4.4.2 Under Impedance Limiter

As a result of incorrectly connected or defective loads, under impedance or even short circuits may be presented to the power amp channels.
In order to detect an under impedance, the microprocessor calculates the resultant impedance. If an impedance of less than 2,66 ohms/channel is detected, the microprocessor limits the signal to the power amp until a subsequent measurement indicates that impedance has risen to a safe level. Whenever the under

impedance limiter is active, the corresponding channel's On LED is turned off. *(See 6 Troubleshooting)*

4.4.3 SOA Protection

Whenever the power transistors leave their Safe Operation Area (SOA), the SOA-protection in stereo mode switches back the current rail of the respective power stage. In mono modes the rails of both channels of one amplifier are switched back.

4.4.4 Speaker Protect Limiter

Whenever the SOA protection of the power amp switches back the current rail there could be a small clipping at the output; but the microprocessor is also triggered by this protection and will reduce the signal level immediately to minimise the effect.

The user can decide either to use Speaker Protect or not. If you use this amp for low frequencies (bass / Sub bass) and you want to squeeze the absolute maximum out of it, Speaker Protect can be switched off. For all other applications (e.g. Full Range) it's recommended to keep Speaker Protect switched on.

4.4.5 DC Protection

Each output of the power amp is constantly monitored for persistent DC voltage levels. If the 3 V thresholds are exceeded at any of the outputs, main SMPS will shut down and the channel at that output will be automatically disconnected. The microprocessor performs a sophisticated strategy to locate the cause of DC. If short-term DC is detected, the amplifier will recover and continue to operate. DC can be located in the output stage, driver stage or at the input of the amplifier.

Output Stage

When a DC voltage is located at an output stage, the main SMPS remains switched off. The On LEDs will show a flash sequence corresponding to this malfunction. *(See 6 Troubleshooting)*

Driver Stage

When a DC voltage is located at the driver stage only the defective channel's output stage and the DCA are muted. The other channel continues to work. The On LED of the defective channel will indicate the malfunction by starting the relevant flash sequence. *(See 6 Troubleshooting)*

Amplifier Input

When DC is located at the input stage only the DCA of the affected channel is muted. (The other channels continue to operate normally). If the DC signal at the input vanishes the microprocessor will de-mute the affected channel and the amplifier will work as usual again.

4.4.6 DC Servo

To prevent DC Offset at the speaker output the **VORTEX** is fitted with two DC Servos per channel. (Hence there are no capacitors in the signal path!)

4.4.7 Over Current Protection

Over current is permanently controlled in the output stage. There are two limiting levels of over current depending on output voltage. These limits will be set automatically. This improves reliability without degrading sound quality when driving complex loads.

4.4.8 Thermal Protection

The microprocessor uses several sensors in the amp in order to ascertain temperature data. If the microprocessor detects a temperature of more than 85 °C at the heat sinks, the input signal on that channel is reduced. If the temperature exceeds 100 °C, the main SMPS is switched off.
The On LED of the overheated channel will start a blinking-sequence.
(See 6 Troubleshooting)

4.5 Mains Protections

4.5.1 Inrush Current Limitation

Within 2 seconds of the **VORTEX** being switched on, the inrush current limiter will increase mains current from nearly zero to nominal value. This value depends on program material, output level and speaker loads.

4.5.2 Mains Over Voltage Detection

Mains over voltage detection is always operative. When the mains voltage exceeds approx. 267 V (230 V operation) or 134 V (120 V operation), the amplifier will be switched off. The system will try to start in intervalls and will return with a soft start when the regular mains voltage returns.

4.5.3 Mains Failure Detection

Mains failure detection is always operative. When the mains supply is interrupted for about 2 mains cycles, the amplifier will be switched off. When the mains voltage returns to a normal value, a soft start occurs.

4.5.4 Fuse Protection

The average mains current can peak temporarily, depending on the load impedance and type of signal, at values significant higher than the nominal value allowed by the fuse protection.
Continuous monitoring of the fuse protection status allows the conditions that would trigger the fuse protection to be predicted. In order to avoid shut-down of the amplifier due to current overload, the amplitude of the input signals will be limited and by hard overloads the amp will be muted for the time.
The limitation of the input signal allows a 6 kW **VORTEX** power amplifier to be operated reliably from a mains power supply of 230V / 16 A (120 V / 30A).

4.6 Main SMPS Protections

4.6.1 Over Current Protection

Main SMPS (Switched Mode Power Supply) transformer current of your **VORTEX** is continuously monitored. If over current occurs, the main SMPS immediately stops working. Should there be an internal failure, this feature prevents other parts being damaged.

4.6.2 Thermal Protection

The temperature of the main SMPS transformer of your **VORTEX** is permanently monitored. If the temperature exceeds 85 °C, the microchip reduces the input signals of both channels. If the temperature surpasses 100 °C, the main SMPS is switched off. The On LEDs will start a blinking sequence corresponding to this malfunction. *(See 6 Troubleshooting)*

4.7 Fans

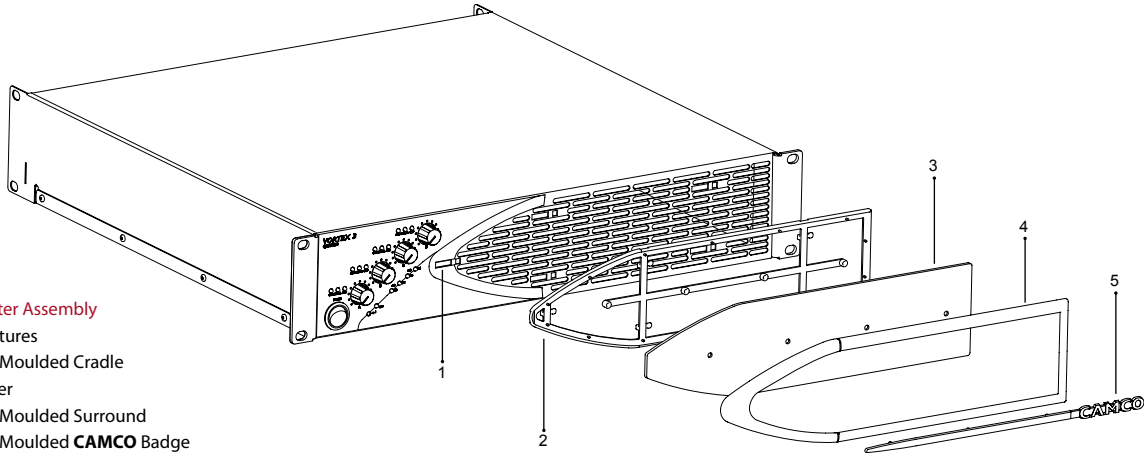
The fans mounted in your **VORTEX** operate permanently, but as long as the temperature remains below 40 °C, they run at their slowest speed and can hardly be heard. The highest detected temperature from either channel controls the speed of the fans. Above 40 °C the speed is increased until it reaches its maximum value.

4.8 Filter Cleaning

The air intake on the front of your **VORTEX** is fitted with a removable filter system. If the filter becomes clogged, the unit will not cool as efficiently as it should and may result in reduced output levels.

For changing the filter, no tools are required: first, gently slide the whole plastic filter assembly a few millimetres to the left and lift it from the front panel. Next, beginning on one of the long sides, carefully unclip the moulded surround (4) from the cradle (2) and then carefully pull the **CAMCO** badge (5) out of the four fastening holes with both hands. Remove the foam filter (3) and clean it with a mild dishwashing detergent and warm water. Once dry, replace the foam filter carefully into the cradle and repeat the dismantling procedure in reverse. Insert the five pins on the filter frame into the clip apertures (1) and slide the filter carefully to the right to secure.

Spare filter assembly's may be ordered from your dealer/distributor.



VORTEX Filter Assembly

1 Clip Apertures
2 Injection Moulded Cradle
3 Foam Filter
4 Injection Moulded Surround
5 Injection Moulded **CAMCO** Badge

5.1 CAI (CAMCO Audio Interface)

CAI is a bus system, in which all significant device functions can be monitored externally and remotely controlled using a master PC. Up to 99 devices can be controlled in parallel in each phase of the bus system, which simply consists of a two-core insulated cable. The master can serve several phases for larger applications. For more information, please contact your dealer or distributor.

CAI allows:

- To control the output-level of each Channel independently (exception: mono modes, only Channel A(C) is affected)
- To mute each channel independently (exception: mono modes, only Channel A(C) is affected)
- To switch the **VORTEX** into STANDBY (and back again)
- To monitor temperature, output-signal, clip, output-current.

5.1.1 Wiring

To connect the **VORTEX** to your CAI system use a fully-wired telephone-type cable with RJ12 connectors. For longer distances use high grade cable like for RS485, DMX512 for AES/EBU digital audio. You can chain several **VORTEX** amplifiers using the second CAI connector on each amplifier. A linear network topology is recommended with 100 Ohm termination at its end. Please refer to RS485 specifications.

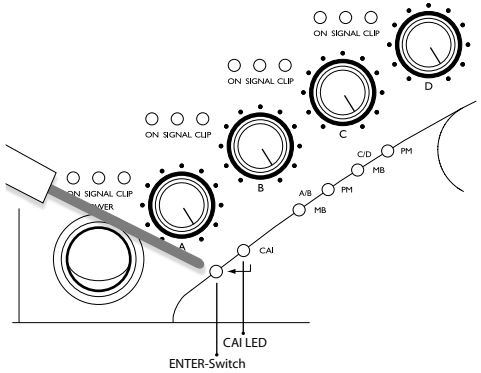
5.1.2 CAI Address Settings

The **VORTEX 3 QUADRO** uses two addresses to communicate with the master PC. You only select the address for amplifier A/B, the address of amplifier C/D is automatically set to address for amplifier A/B plus one.

The CAI address selection procedure will not affect the operation of the **VORTEX** but whilst this procedure is active, the volume cannot be adjusted by using the pots.

NOTE: Ensure you return both pots to their original position after address selection is complete, otherwise the amplifier will change its volume level to the new pot positions!

Briefly press the ENTER-Switch ↵. This push button switch can be accessed through the 3 mm hole in the front panel located between the On/Off switch and the LEDs.



Example of LED sequences for different address settings:

Adresses (A/B)/(C/D)	On-LED Channel A => Tens	On-LED Channel B => Units
01/02 (factory settings)	0* flash	1* flash then short pause
25/26	2* flashes then short pause	5* flashes then short pause

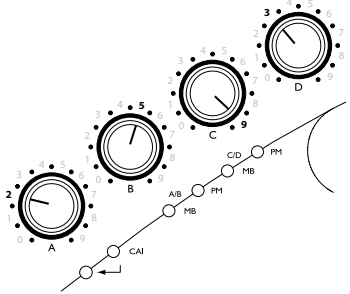
After briefly pressing the Enter-Switch ↵ the actual address of amplifier A/B will be displayed by the On LEDs of ChA and ChB. The address of amplifier C/D is not shown.

- Flashing of On LED channel A indicates the tens
- Flashing of On LED channel B indicates the units of the address of amplifier A/B

These sequences are repeated for 30 seconds (timeout). Then the On LEDs return to their normal function.

To change CAI addresses, turn the appropriate volume potentiometer to the required address of amplifier A/B (Volume Pot Ch A => Tens, Volume Pot Ch B => Units). The address of amplifier C/D is automatically set to address for amplifier A/B plus one.

To adjust the address you can use the scale markings of the potentiometers. You will find the digits 0,1,...,9 on the 10 scale spacing .



The current selected address of amplifier A/B will be immediately displayed but NOT automatically stored or activated! After each turn of pot you have another 30 seconds to timeout. You can leave this procedure without saving the new addresses by briefly pressing the Enter-Switch or waiting for timeout (as described above).
To store and activate the new addresses you have to press the Enter-Switch for 3 seconds. These new addresses are stored in an EEPROM, which holds the information even if the amp is subsequently disconnected from mains. Be sure to set the CAI-Master-PC to these new addresses. If not, the communication will be interrupted.

5.1.3 CAI Status Indicator

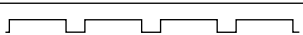
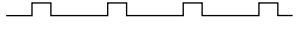
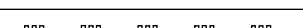
This green LED indicates the presence of communication between PC and the amp.

6.1 On LED Flashing Sequences

When switching on the amp the On LEDs flash twice accompanied by a flash of Clip LEDs. This is normal for the 'Start' sequence of the **VORTEX**.

When switching off the amp the On LEDs flash several times followed by a flash of Clip LEDs. This is normal for the 'Shut Down' sequence of the **VORTEX**. (It is the same as the loss of the mains voltage.)

In the following table you will find the possible LED sequences of the On LEDs:

Operating Status	**LED Sequence (⎍) = flash, (_) = off**	**Description of repeated sequences**
Normal (no failure)	Permanently lit	
Power Fail (i.e. switch off)		Short 50 ms flash + 950 ms pause
High Temperature signal attenuation		750 ms flash + 250 ms pause
Over Temperature: main SMPS off		250 ms flash + 750 ms pause
DC reason unknown		250 ms flash + 250 ms pause
DC input-signal-faul		3 * flashing + 0.5 s pause
DC fault in driver stage		4 * flashing + 0.5 s pause
DC output stage defect		5 * flashing + 0.5 s pause
Output Stage Defect without DC		6 * flashing + 0.5 s pause
Main SMPS off (unless Hi Temp/Power Fail)		2 * flashing + 0.5 s pause

Examples of LED Sequences

LED sequence: Ch1:
Ch2:
Ch3:
Ch4:

Failure: Ch1: high temperature with signal attenuation
Ch2: normal operation
Ch3: normal operation
Ch4: normal operation

LED sequence: Ch1:
Ch2:
Ch3:
Ch4:

Failure: Ch1: DC, output stage defect
Ch2: main SMPS off
Ch3: main SMPS off
Ch4: main SMPS off

6.2 Problem: No Sound

Indication: On LEDs not lit
Clip LEDs not lit

- Check AC plug.
- Confirm that AC outlet works by plugging in another device.

Indication: On LEDs lit
Signal LED not lit

- Make sure the signal source is operating and try another cable.
- Check position of Volume Pots.

Indication: On LEDs lit
Signal LEDs responding to signal level

- Check the speaker wiring for breaks.
- Try another speaker and cable.

Indication: On LED(s) sequence

The amplifier is in protective muting. Refer to On LED flashing sequences table to find out the cause for the mute.

- Overheating will cause protective muting.
- Check for proper ventilation. If the fans aren't running the amplifier requires servicing.

6.3 Problem: No Sound or Sound Is Too Low

Indication: On LED not or sporadically lit
Signal LED not lit
Clip LED lit

Under Impedance Limiter is active. The load impedance is abnormally low or shorted.

- Unplug each speaker one-by-one. If the On LED indicates normally when you disconnect a cable, that cable or speaker is shorted.
- Take care not to use too many speakers in parallel, which would result in an impedance that is too low for normal operation!

Indication: On LED(s) sequence

Please refer to the On LED flashing sequences table to find out which protection is active. High temperature will cause an attenuation of output level! DC will cause the amp to mute or shut down.

- Switch off the **VORTEX** and unplug the source from the amp's input to prevent DC entering the amp via the signal source. Then switch on the **VORTEX**. If the On LED shows the same sequence, the amp will need to be serviced by a qualified technician.

All other On LED sequences that shut down or mute the VORTEX indicate a serious internal fault. At this point, turn the VORTEX off, remove AC power and have the amplifier serviced by a qualified technician.

6.4 Problem: No Channel Separation

- Check the mode indicators on the front panel and make sure the mode selector on the rear panel is in the stereo-position.
- Make sure other equipment in the signal path such as mixers and preamps are set for stereo, not mono.

6.5 Problem: Distorted Sound

Indication: On LED lit
Signal LED responding to signal level
Clip LED lit only green

- A faulty speaker or a loose connection could cause this. Try another speaker and check the wiring.
- The signal source might be clipping. Keep the **VORTEX** volume pots at least halfway up so that the source does not have to be overdriven.
- Keep the **VORTEX** volume pots at least halfway up and try changing input sensitivity from 1,4 V to 32 dB or 26 dB with the gain selector on the rear.

6.6 Problem: Hiss

- Unplug the amplifier input to confirm that the hiss is coming from the source or from a device upstream. Erratic or popping noises indicate an electronic fault in the offending unit.
- To keep the noise floor low, operate the primary signal source at full level, without clipping.
- Avoid boosting the signal further between the source and the amplifier.

6.7 Problem: Squeals and Feedback

- Microphone feedback should be controlled with mixer controls. If noise continues to build up with no microphone gain, there is a serious fault in the signal processors or cables. Working in succession from the signal source towards the amplifier and check each device in the signal path by reducing its gain or by unplugging it.

	VORTEX 3 Quadro		
Output Power 1 kHz, THD < 0,1 % , in mono-bridge mode	2 x 1500 W / 8 Ω 2 x 900 W / 16 Ω		
1 kHz, THD < 0,1 %, in parallel-mono mode	2 x 1500 W / 2 Ω 2 x 900 W / 4 Ω		
1 kHz, THD < 1 %, all channels driven Duration limited by fuse / thermal protection for RL < 8 Ω in stereo mode or RL < 16 Ω in mono-bridge mode. Measurement at 2 Ω without preconditioning (EN 60268-3)	4 x 750 W / 4 Ω 4 x 450 W / 8 Ω		
Circuitry	Bipolar, Class H 2-step high efficiency circuit		
Signal to Noise-Ratio			
20 Hz - 20 kHz, 8 Ω load, unweighted	>103 dB		
A-weighted	>106 dB		
Power Consumption @ 230 V		Typical[1]	Max[2]
(all channels driven)	Idle	1,4 A / 67 W	
Multiply currents by 2 for 120 V	16 Ω	3,9 A / 385 W	10,1 A / 1490 W
	8 Ω	5,6 A / 638 W	17,1 A / 2650 W
	4 Ω	7,8 A / 1070 W	28,1 A / 4440 W

[1] 1/8 of max Output Power with pink noise to represent typical music signal
[2] max. rated Output Power (see above)

Frequency Response	20 Hz - 20 kHz ± 0,15 dB 8 Ω load, 1 dB below rated power
Input Impedance	40 kΩ balanced
Voltage Gain	selectable: 26 dB, 32 dB, or 1,4 V input sensitivity
Protection Circuits	inrush-current limitation, temperature monitoring of transformers and heat-sinks, output DC protection, power transistor SOA protection, output over current protection, under impedance limiter, intelligent mains fuses protection
Limiter	switchable clip- and speaker protect limiter
Fan	2 temperature dependent speed-controlled axial fans
Ground Lift	input ground lift switch on back panel
Indicators	LEDs for On, Signal, Clip, indicating additionally Output Current and faults for example like DC and High Temp
Input Connectors	3-pin XLR, male and female per channel, pin 2 = inphase
Output Connectors	one 4-pole SPEAKON connector for each output channel (bi-amping possible)
Modes of Operation	Stereo, Mono-Bridge and Parallel-Mono
Options	Extended User Interface / E.U.I. – modules for any kind of EQ
THD+N (typical) 20 Hz - 10 kHz, 8 Ω load, 3 dB below rated power	< 0,01 %
SMPTE (typical) 20 Hz - 20 kHz, 8 Ω load, 3 dB below rated power	< 0,01 %
Damping Factor 8 Ω load, 1 kHz and below	> 400
Dimensions (WxHxD)	483 x 88,9 x 420 mm (19", 2U)
Net Weight	12,4 kg
Shipping Dimensions (WxHxD)	600 x 205 x 600 mm (0,074 m³)
Shipping Weight	15 kg

We reserve the right to make technical alterations without prior notice

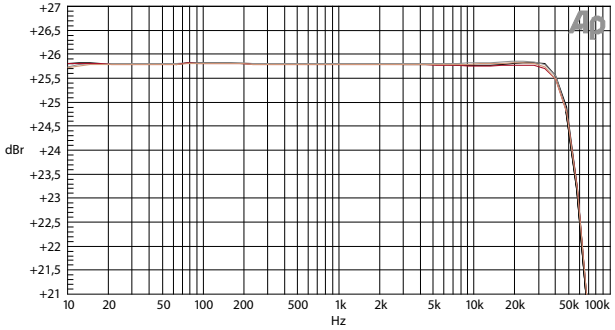


Figure 8.1

Gain vs. frequency

(Measurements of a typical performance)

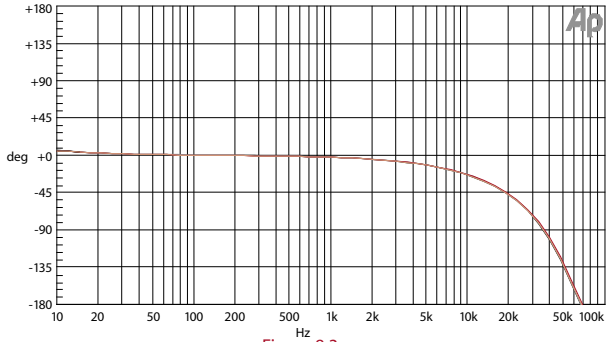


Figure 8.3

Phase vs. frequency

(Measurements of a typical performance)

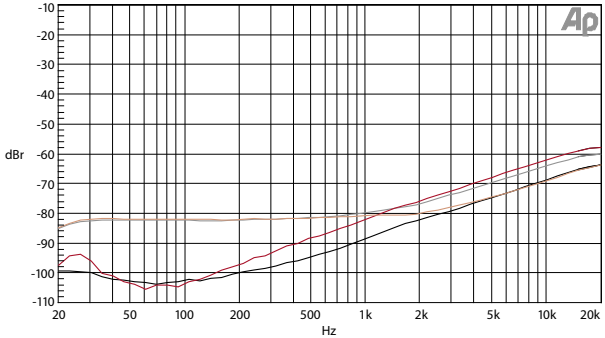


Figure 8.2

Channel separation vs. frequency

(Measurements of a typical performance)

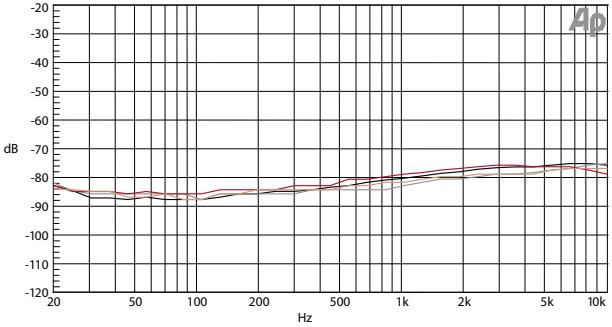


Figure 8.4

THD + N vs. frequency (BW 22 kHz), 3 dB below clip, 8 Ohms

(Measurements of a typical performance)

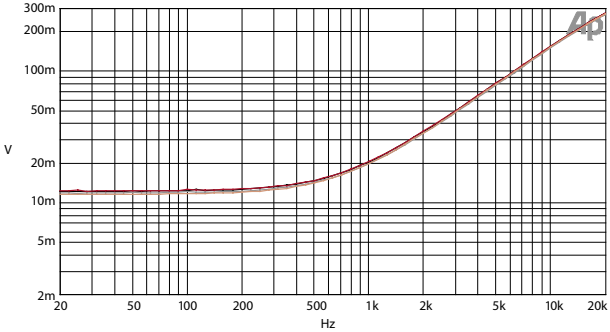


Figure 8.5

Output Impedance vs. frequency @ 1 Amp RMS injected current
equivalent 11 mΩ + 2,1 µH *(Measurements of a typical performance)*

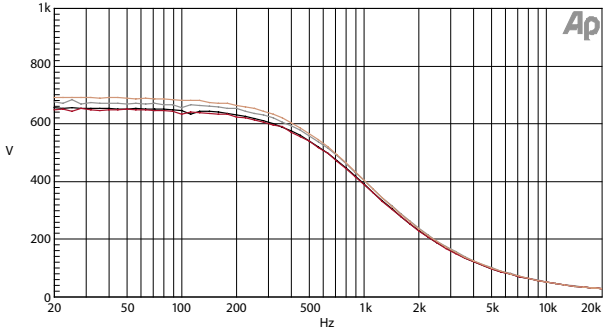


Figure 8.7

Damping factor into 8 Ω vs. frequency
equation: damping factor = loaded impedance / amplifier output impedance
(Measurements of a typical performance)

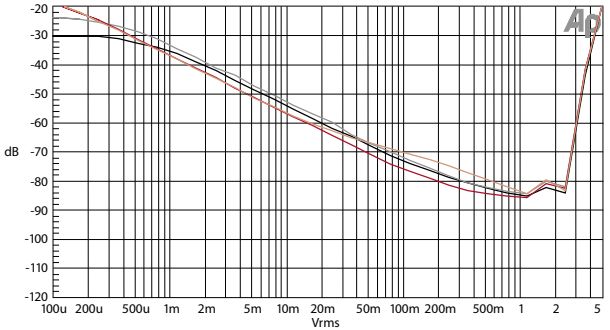


Figure 8.6

THD+N @ 1 kHz, 4 Ω load vs. input voltage
(Measurements of a typical performance)

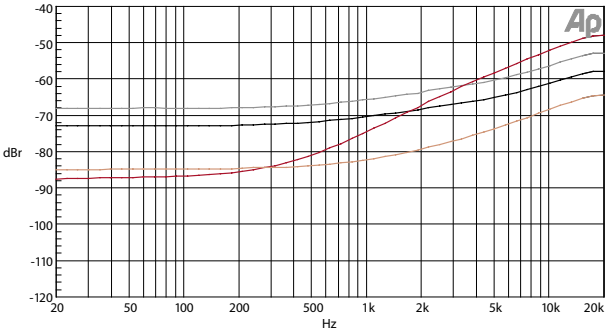


Figure 8.8

CMRR
(Measurements of a typical performance)

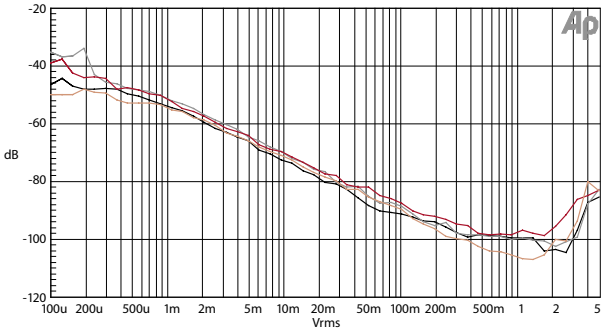


Figure 8.9

CCIF difference frequency method (10,5 kHz und 11,5 kHz) @ 8 Ω
vs. input level *(Measurements of a typical performance)*

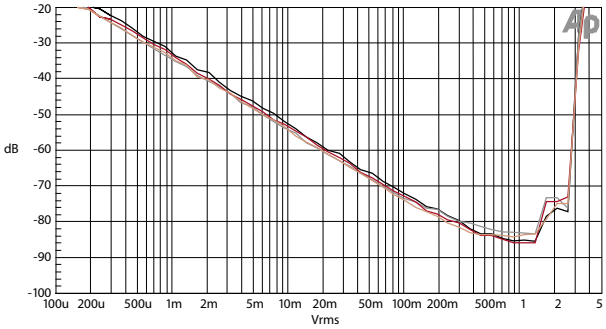


Figure 8.10

SMPTE Intermodulation distortion (60 Hz und 7 kHz) @ 8 Ω
vs. input level *(Measurements of a typical performance)*

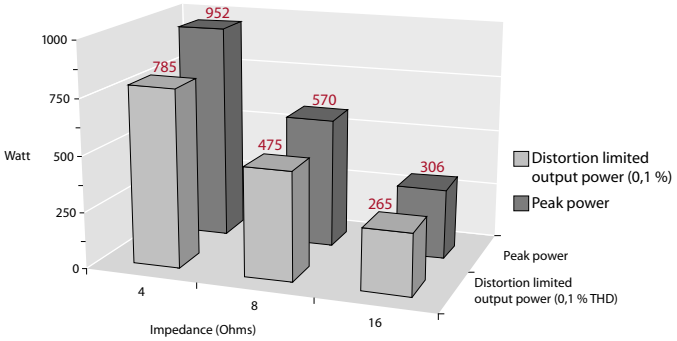


Figure 8.11

VORTEX 3 Quadro *(Measurements of a typical performance)*

9.1 Summary Of Warranty

CAMCO guarantees the **VORTEX** amplifier to be free from defective material and/or workmanship for a period of three years from the date of sale. Provided that the amplifier is returned to your dealer/distributor in a factory pack with a copy of the proof of purchase, i.e., sales receipt, **CAMCO** will repair faulty products under this warranty when a defect occurs under normal installation and use.

This warranty provides that examination of the returned product must indicate, in our judgment, a manufacturing defect.

9.2 Items Excluded From This Warranty

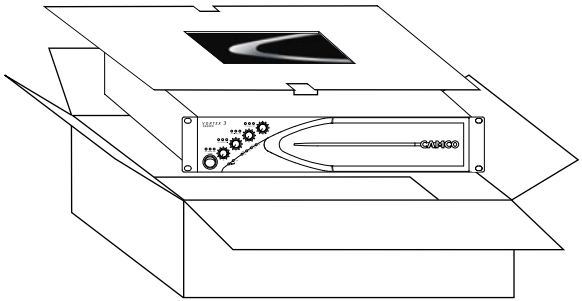
CAMCO is not liable for any damage caused by shipping accidents, misuse, abuse, operation with incorrect AC voltage, operation with faulty associated equipment, modification, or alteration without prior factory approval, service by an unauthorised service center, and normal wear and tear. Amplifiers on which the Serial Number has been removed or defaced are not eligible for warranty service.

9.3 What CAMCO Will Do

CAMCO (or its appointed agent) will rectify any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund, as it sees fit.

9.4 How To Obtain Warranty Service

You must notify your dealer/distributor of your need for warranty service. All components must be shipped in a factory pack.



9.5 CAMCO's Product Improvement

Due to **CAMCO's** policy to continuous product improvement, specification is liable to change without notice. Please consult your dealer/distributor or **CAMCO** direct for clarification if necessary.

PLEASE ENCLOSE THIS COMPLETED FORM WITH THE AMPLIFIER
DO NOT SEND SEPARATELY

10.1 Owner's Information

Company Name: _ _ _

11 Maintenance Information

Cleaning and servicing the inside of the aplifier must never carry out by unqualified personnel. The amplifier must never be opened by unqualified personnel.

Cleaning and servicing work on the inside of the amplifier must only be carried out by qualified personnel.

Qualified personnel is defined as a person who has gained specialised relevant knowledge of electronic engineering through education, training and experience and who has sufficient knowledge of all relevant governmental work safety regulations to be in a position to judge the safe functioning of power amplifiers based on technical rules according to IEC 60065.
(IEC 60065 (Din EN 60065) Safety Requirements for Audio, Video or simlar Electronic Appliances)

In order to guarantee the safe functioning of the amplifier, it has to be checked regularly, depending on its application but at least once a year, by a properly qualified person.
Advice on how to carry out these checks can be found in DIN VDE 0702-1 Safety Checks for Electronic Appliances.

An amplifier that is considered to be unsafe must be labelled accordingly and stored in a safe place to prevent this amplifier being used mistakenly.

12 Decomissioning

During the decomissioning process of the amplifier, all legally prescribed rules and procedures must be adhered to.

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